ANNAMACHARYA COLLEGE OF PHARMACY

(AUTONOMOUS)

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ASTRINGENTS

Lecture by

Dr. D. Vasavi devi,

Associate Professor,

Department of Pharmaceutical Analysis ,

Annamacharya College of Pharmacy, Rajampet.

“Brings about protein precipitation.”

E.g.: Alum

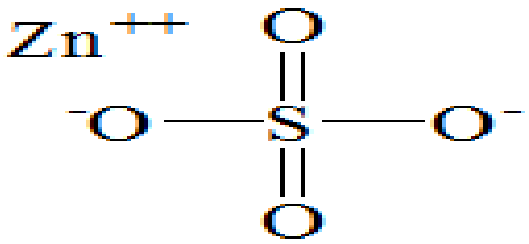
- An astringent substance is a chemical compound that tends to shrink or constrict body tissues and precipitate the protein and the astringent form protective layer on the surface.
- Due to their **protein precipitation** action, astringents are able to **reduce the cell** permeability.
- This reduces local edema, exudation and inflammation.
- They are usually applied to damage skin topically or to the mucous membrane of GIT including the mouth

CHARACTERISTICS

- Affect only the superficial layer. Reduce cellular permeability.
- Make the surface mechanically strong, decrease exudation.
- Protect from external irritation.
- Possess local styptic and local antiseptic action.
- May interfere with the function of pain receptors. The pain relieving action is mild.
- Constrict the blood vessels to stop bleeding.

ZINC SULFATE

Molecular formula: $ZnSO_4$



Zinc sulfate

Molar mass (weight)

- *Anhydrous*

  Zinc sulfate ($ZnSO_4$) *161.47 g/mol*

- *Zinc sulfate monohydrate*

  ($ZnSO_4$ H_2O) *179.47 g/mol*

- *Zinc sulfate heptahydrate*

  ($ZnSO_4$ $7H_2O$) *287.53 g/mol*

PREPARATION

1) Specific reactions the reaction of the metal with aqueous sulfuric acid

$$Zn + H_2SO_4 + 7H2O \rightarrow ZnSO_4\ 7\ H_2O + H_2$$

2) Pharmaceutical grade zinc sulfate is produced by treating high purity zinc oxide with sulfuric acid

$$ZnO + H_2SO_4 + 6H_2O \longrightarrow ZnSO_4 \cdot 7\,H_2O$$

3) Zinc sulfate also obtained by heating Zinc blende (Zinc sulphide) in presence of air

$$ZnS + O_2 \rightarrow ZnSO_4$$

PROPERTIES

- ***Appearance : Colorless transparent crystals / Crystalline powder***
- ***Odor : Odorless***
- ***Taste : Astringents and metallic taste***
- ***Solubility: water & glycerin – soluble***

  Alcohol - insoluble

- When heated over 68^0 C, zinc sulfate decomposes into sulfur dioxide gas and zinc oxide fume, both of which are hazardous:

$$\mathbf{ZnSO_4 \rightarrow SO_2 + ZnO}$$

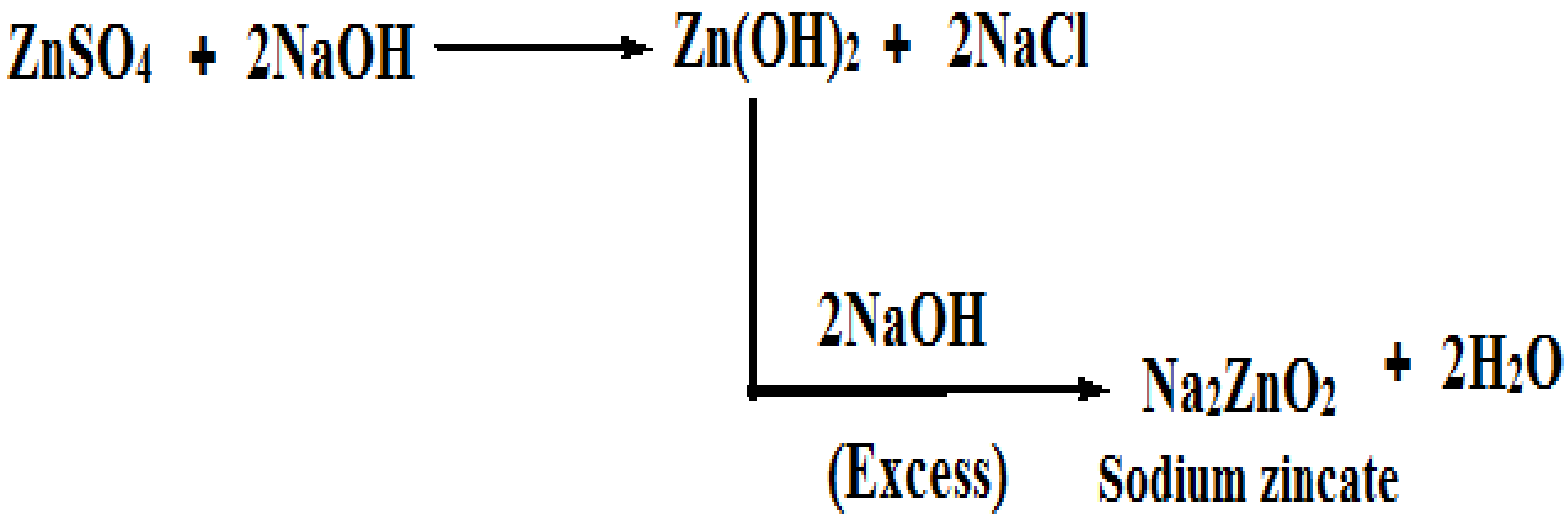
- Dehydration of Zinc sulfate heptahydrate:

$$ZnSO_4\,7H_2O \xrightarrow{50^0\,C} ZnSO_4\,2H_2O \xrightarrow{100^0\,C} ZnSO_4\,H_2O \xrightarrow{450^0\,C} ZnSO_4 \xrightarrow{740^0\,C} SO_2 + ZnO$$

- It is reported to form double salts with Potassium and Ammonium sulfate

$$ZnSO_4 + (NH_4)_2\,SO_4 \longrightarrow ZnSO_4\,(NH_4)_2\,SO_4\,6H_2O$$

- A white precipitate of Zinc hydroxide is formed when Zinc sulfate react with **NaOH** and white precipitate of Zinc hydroxide is solubilized in excess of **NaOH** & form Sodium zincate



IDENTIFICATION TEST

- Aqueous solution of substance gives reactions characteristic of **Zinc** & **Sulphate**
- **Zinc**

1) $ZnSO_4 + 2NaOH \longrightarrow Zn(OH)_2 + 2NaCl$

$Zn(OH)_2 + 2NaOH \text{ (Excess)} \longrightarrow Na_2ZnO_2 + 2H_2O$ (Sodium zincate)

$Na_2ZnO_2 + Na_2S + 2H_2O \longrightarrow 4NaOH + ZnS\downarrow$

2) $2Zn^{2+} + [Fe(CN)_6]^{4-} \rightarrow Zn_2[Fe(CN)_6]$ (ppt)

TEST FOR PURITY

- Tested for

  Acidity, Al, Cu, Mg, Mn & Ni,

  As, Fe, chloride & alkalis and alkaline earths

Test for Al, Cu, Mg, Mn & Ni:

1 g sample in 20ml H_2O

+

excess dilute solution of Ammonia

The solution should remain colourless & form no precipitate

ASSAY -Gravimetrically

- **$ZnSO_4$** is converted to Zinc carbonate by sodium carbonate
- Then it is converted to zinc oxide by ignition
- The residue (ZnO) is weighed

$$ZnSO_4 + Na_2CO_3 \rightarrow\rightarrow ZnCO_3\downarrow + Na_2SO_4$$

$$ZnCO_3 \rightarrow\rightarrow ZnO + CO2$$

Assay Procedure

- 1 g sample + 100ml water, solution is heated to 90°C
- To the hot solution + **Na_2CO_3** with constant stirring untill the complete precipitation of **$ZnCO_3$** is obtained
- Excess **Na_2CO_3** should be avoided
- The precipitated **$ZnCO_3$** solution is boiled for few minutes, filtered through tared Gooch crucible
- Washed with hot water, until it is free from alkali
- The residue is dried, ignited & weighed
- 1 g of residue = 1.984 g of $ZnSO_4$

DOSE & STORAGE

- **Dose:** 0.6 to 2 g
- **Storage:** It is preserved and stored in well-closed containers in a cool place.

USES

- In medicine it is used together with Oral Rehydration Therapy (ORT) and an **astringent**
- Zinc sulfate is an inorganic compound and dietary supplement. As a supplement it is used to treat zinc deficiency.
- 0.25% Zinc sulfate used for **ophthalmic purpose.**
- Zinc sulfate acts as **emetics.**
- It is used as in electrolytes for zinc plating, as a mordant in dyeing, as a preservative for skins and leather.

ALUM

POTASH ALUM

- **General formula** $KAl(SO_4)_2$**.** $\mathbf{xH_2O}$ **for Alum**
- **Synonym** Potash alum,

  Aluminum potassium sulfate
- **Molecular formula** $KAl(SO_4)_2 \cdot 12H_2O$
- **Molecular Wt.** 474.07

PREPARATION

- Potash alum obtained by adding a concentrated solution of potassium sulfate to a hot solution of an equimolecular proportion of aluminium sulfate.
- When the solution is concentrated and cooled, characteristic octahedral crystals separated out.
- $K_2SO_4 + Al_2(SO_4)_3 + 24H_2O \longrightarrow 2KAl(SO_4)_2 \bullet 12H_2O$

PROPERTIES

- Colorless, transparent, crystalline structure.
- Readily dissolves in water & insoluble in alcohol
- Sweetish astringent taste.
- It is acidic in nature and an alum powder solution turns a litmus paper red.
- On heating, alum powder changes to liquid first and if heated further, then the salt starts swells up to form froths.

Identification test

- **Gives reactions for**
- Aluminium,
- Potassium &
- Sulphate

Test for purity

- It is tested for As, heavy metals, Fe, and zinc.
- Alum is also required to comply with a test for ammonium salts

ASSAY- GRAVIMETRIC METHOD

2 g Alum

+

300ml water

+

20 ml **Ammonium chloride solution**+ 5 drops *of Methyl red*

+

sufficient quantity of **Ammonia s**olution to produce a distinct yellow colour

The solution is heated to boiling point

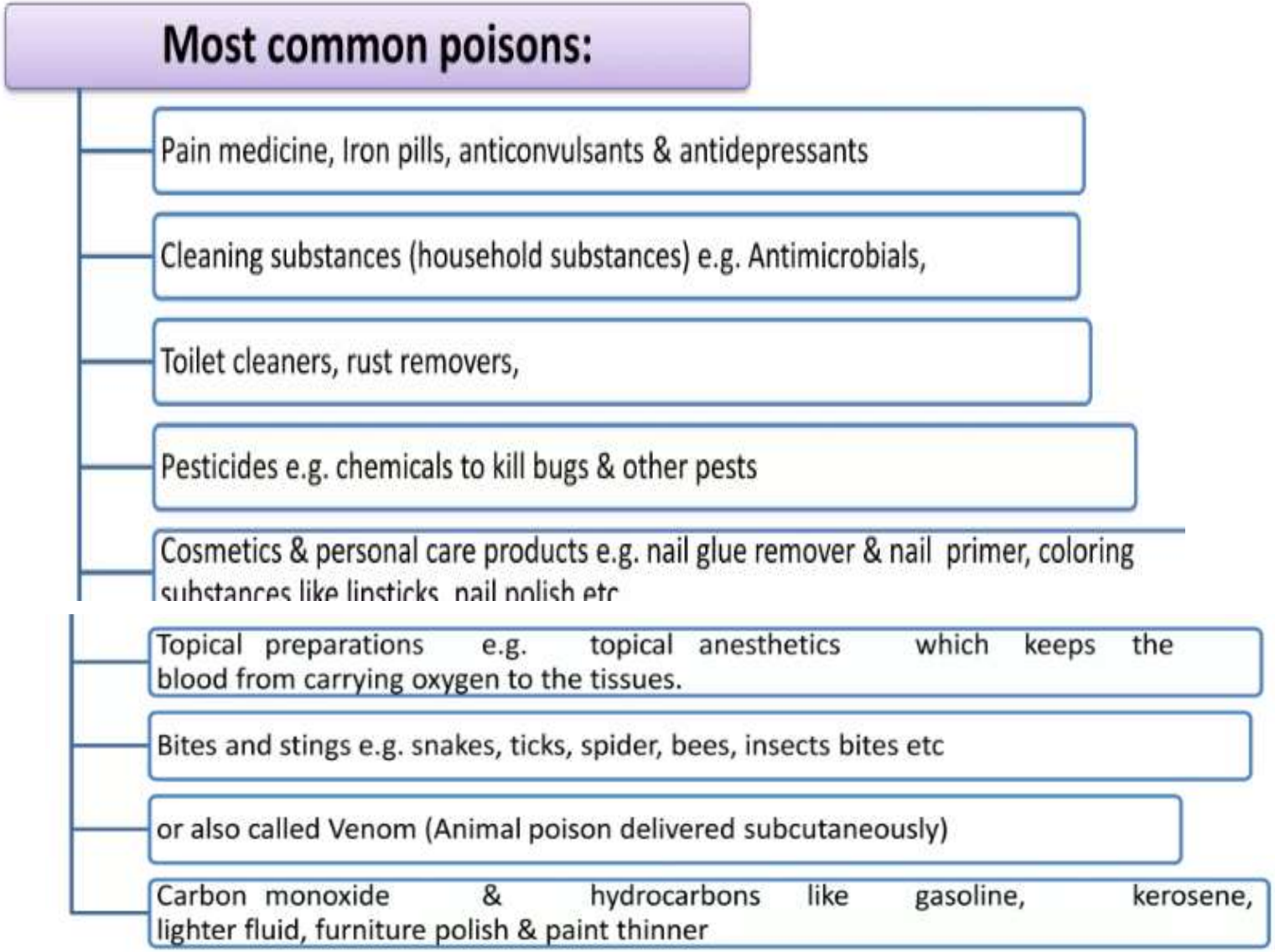
Then, it is filtered & the precipitate washed with a 2.5 % solution of **Ammonium nitrate** until it become free from chloride

The precipitate of **Al_2O_3** (Aluminum oxide)is dried to a constant weight at 120°C & weighed

USES

- Externally – astringent
- Antiseptic & local styptic
- Alum in rock form is used as an aftershave. If it is rubbed on a freshly shaved face, its **astringent property** helps to prevent and reduce bleeding in minor cuts and abrasions.
- Alum's has a strong antibacterial property and so it is useful as a natural deodorant by inhibiting the growth of the bacteria responsible for body odor.
- Alum is listed as an ingredient of toothpaste or toothpowder and pharmaceutical aid..
- Alum acts also as a **styptic** to contract organic tissues and stop or reduce hemorrhage and bleeding.
- It is also used as an emetic agent to induce vomiting when a person has swallowed poison.
- As a pharmaceutical aid

Poison & Antidotes



Poison:

- Any substance that is harmful to your body
- Any substance that cause disturbances in organisms.
- You might swallow it, inhale it, inject it or absorb through skin.

Classification : poisons (chemicals) can be divided into three broad groups as per there sources

- Agricultural and industrial chemicals
- Drugs and health care products
- Biological poisons

1. Agricultural chemicals

- Pesticides: which include insecticides, herbicides, fungicides, fumigants, and rodenticides.

- **Industrial** chemicals: hydrocarbons chlorinated hydrocarbons, aldehydes, ketones, alcohols, esters etc. as well as chemicals found in or near households

- Poisoning with industrial chemicals occurs most often by either through skin (percutaneous) or inhalation routes.

2. Drugs and health care products

Pain medicine, Iron pills, anticonvulsants & antidepressants & cosmetics etc

3. **Biotoxins or Biological poisons:**can be conveniently grouped into 3 major categories:

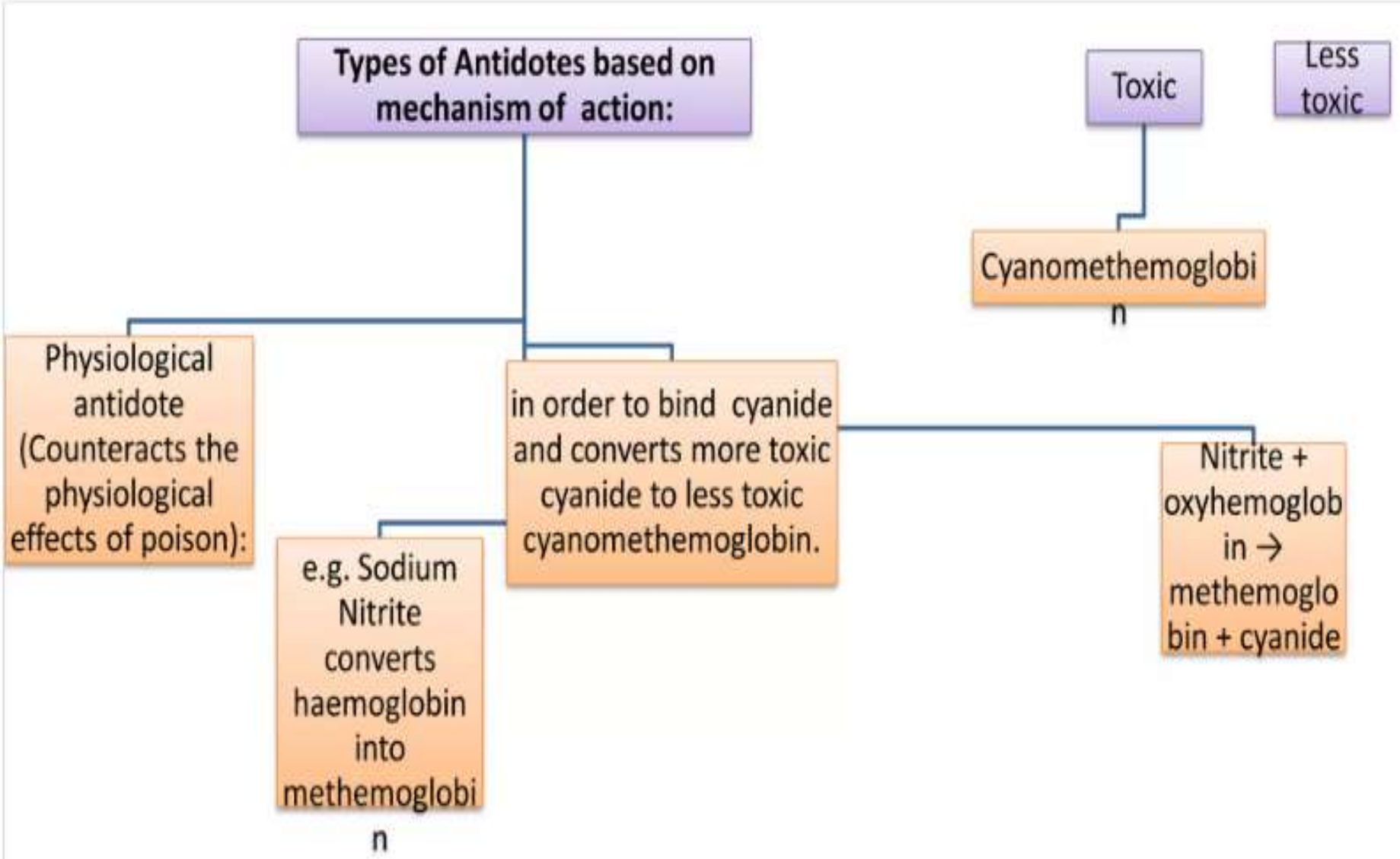
Microbial toxins- poisons produced by bacteria like blue green algae, dinoflagellates, golden brown algae etc.

Phytotoxins-poisons produced by plants .

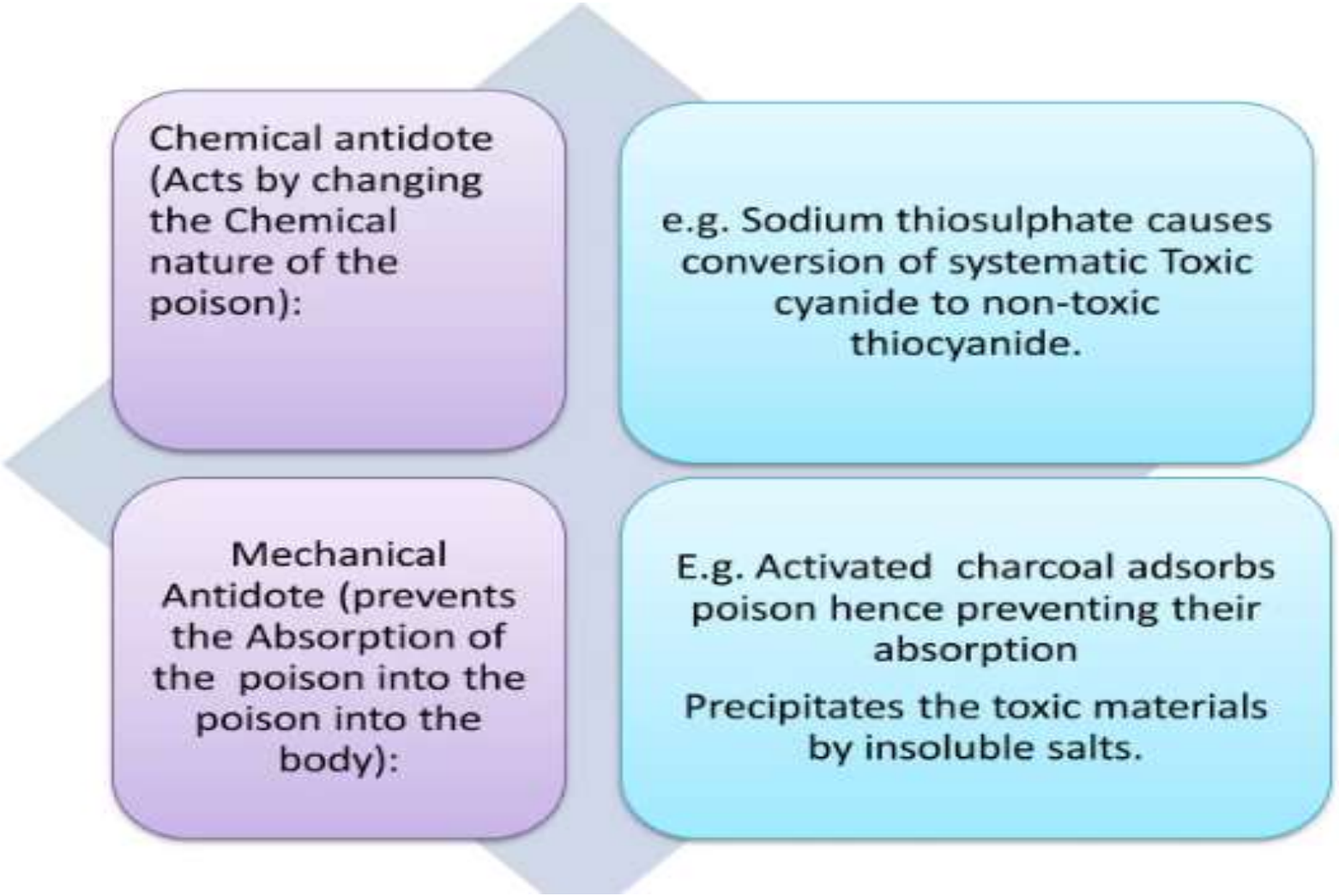
Zootoxins-Poisons produced by animal.

"Antidote" Substances used to counteract the action of these chemicals or form of poisoing are called

Antidote


Types of Antidotes based on mechanism of action:
Toxic
Less toxic
Cyanomethemoglobin
Physiological antidote (Counteracts the physiological effects of poison):
in order to bind cyanide and converts more toxic cyanide to less toxic cyanomethemoglobin.
Nitrite + oxyhemoglobin → methemoglobin + cyanide
e.g. Sodium Nitrite converts haemoglobin into methemoglobin

Types of Antidote Based on Mechanism



Antidote in most common use

Cyanide poisoning: Sodium Nitrite ($NaNO_2$), Sodium Thiosulphate ($Na_2S_2O_3$)

Universal Antidote: Activated Charcoal

- **Activated Charcoal**

It is similar to common charcoal but is made especially for medical use.

During its preparation the wood charcoal is treated with various substances like steam, air, CO_2, Oxygen, $ZnCl_2$, Sulphuiric acid or phosphoric acid - helps charcoal to develop many internal spaces or "pores".

These pores help activated charcoal trap chemicals – strong adsorptive agent.

Activated Charcoal

Odourless, tasteless, fine black powder.

Insoluble in water or any other solvents.

Adsorb effectively all heavy metals, viruses, bacterial & fungal toxins by binding poisons within GIT and prevents its absorbtion.

This allows their transfer out of the body in a harmless form.

Common drug poisoning is - aspirin, charcoal should be given within the first 30 min of an overdose or aspirin poisoning.

Powdered form of it reaches its maximum rate of adsorption rapidly within one min compare to other forms.

It is mainly known both for its use in drug overdoses and chemical poisonings.

It act to purify & cleanse the body due to its amazing ability to attract poisons to itself.

Uses:

In treating poisoning and overdoses through oral, injection rout

in air purification, gold purification, metal extraction, water purification, medicine, sewage treatment, air filters in gas masks.

Pregnancy in which normal flow of bile is affected (cholestasis)

Prevent gas, Reduce high cholesterol & to Prevent a hangover.

Side effects: constipation and black stools.

Rare, side effects are a slowing or blockage of the intestinal tract & dehydration.

Stomach cramps & swelling of the abdomen.

Dose: adults :25-100g & children:25-50g

Sodium Nitrite

Chemical formula $NaNO_2$.

white to slightly yellowish crystalline powder

very soluble in water and is hygroscopic

contains not less than 97.0% & not more than 101.0% of sodium nitrite

It can act as both oxidizing & reducing agent.

When its reacts with oxidizing agent, nitric oxide (NO) is the product in acidic solution

Nitrogen gas is in neutral to alkaline solutoin.

Uses: it is used as a antidote for cyanide poisoning

Side effects: head pain, blurred vision.

Dose: 30 –120mg.

It give pale brown fumes of nitrous acid with dilute acids

$2NaNO_2 + H_2SO_4 \rightarrow Na_2SO_4 + 2\ HNO_2$

$3HNO_2 \leftrightarrow HNO_3 + 2\ NO\uparrow + H_2O$

$2NO + O_2 \rightarrow 2NO_2$

Method of Analysis:

About 10 ml of 1% w/v aqueous solution is added by a pipette to 0.1 N $KMnO_4$ soluton acidified with sulfuric acid

The formed unstable nitrousacid (HNO_2) readily breaks down into oxide & nitric nitrogen dioxide

$2HNO_2 \rightarrow NO + NO_2 + H_2O$

Nitrous acid also behaves as a reducing agent for it may be oxidised to nitric acid by $KMnO_4$.

A known excess 25 ml of 0.1N oxalic acid is added & heated. is back titrated with 0.1N $KMnO_4$. Oxalic acid is quantitatively oxidized on warming.

- $NaNO_2 + H_2SO_4 \rightarrow HNO_2 + NaHSO_4$ $HNO_2 + O \rightarrow HNO_3$

$H_2C_2O_4 + O \rightarrow H_2O + 2CO_2\uparrow$

Factor: Each ml of 0.1 N $KMnO_4$ is equivalent to 0.00345 g of $NaNO_2$.

precursors to many dyes, such as diazo dyes.

A reagent for conversion of amino into diazo compounds

Industrial production of organonitrogen compounds

Nitroso compounds are produced

These are used in the rubber industry.

spoilage or disease causing microorganisms.

its effectiveness depends on residual nitrite level,

pH, salt concentration, reductants present, iron content.

Sodium Thiosulphate

Colorless, water-soluble salt.

Calcium-chelating agent.

Used in removing toxic substances from body.

salt can be injected, taken orally, or applied to the skin.

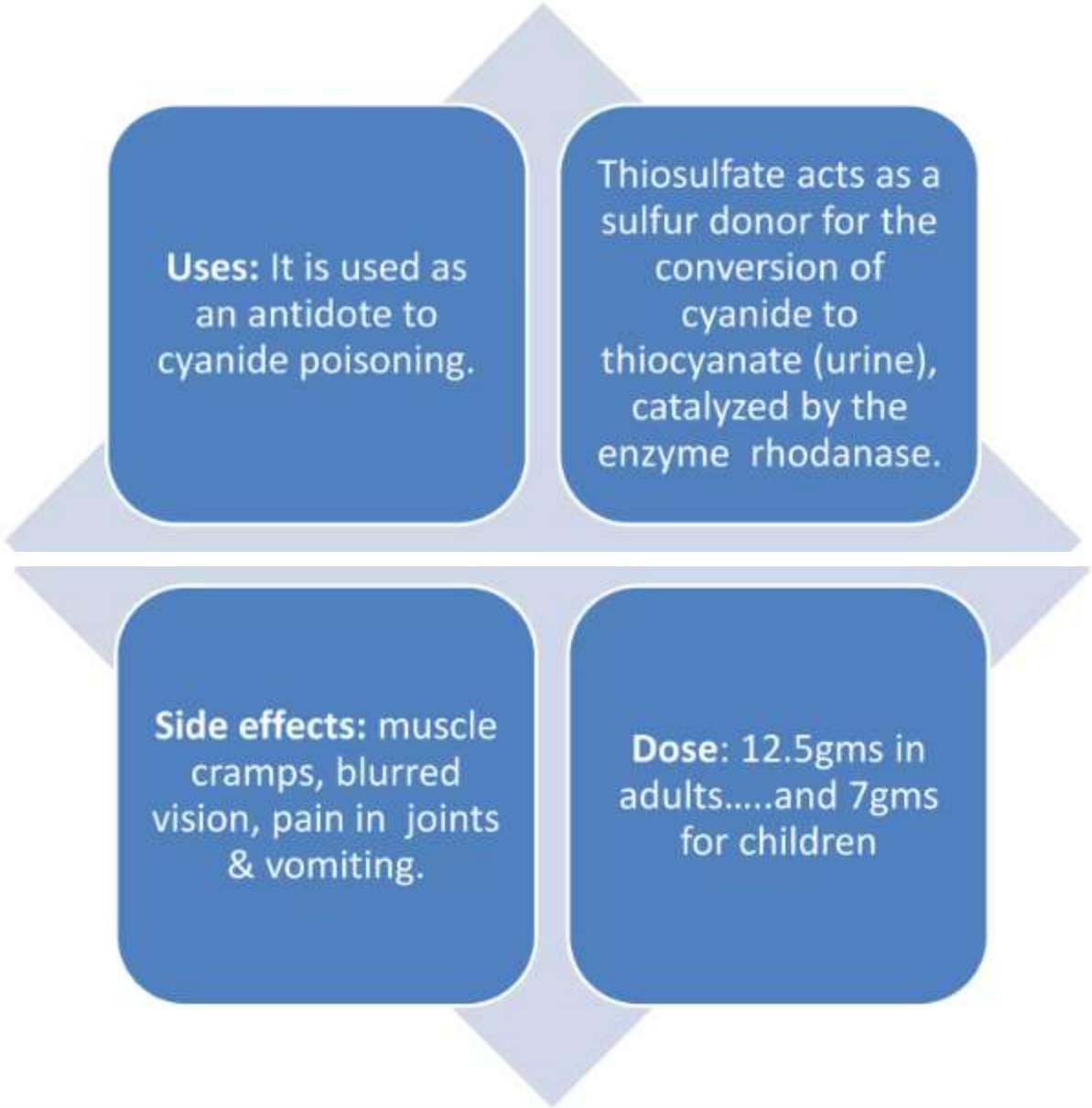
It is also used in some vital tests for kidney patients to glean information without doing harm.

In combination with sodium nitrite used as an antidote for cyanide poisoning in both children and adults.

reacts with the cyanide and forms sodiumthioyanate, a nontoxic substance that can then be excreted harmlessly

Used to treat arsenic poisoning.

Useful in removing excess copper from patients too.


Uses: It is used as an antidote to cyanide poisoning.
Thiosulfate acts as a sulfur donor for the conversion of cyanide to thiocyanate (urine), catalyzed by the enzyme rhodanase.
Side effects: muscle cramps, blurred vision, pain in joints & vomiting.
Dose: 12.5gms in adults.....and 7gms for children

Preparation

- Few grams of the sodium carbonate are dissolved in 300ml of hot water & about five-sixths of the solution is placed in one flask and the remainder in another flask.
- Those flaks are connected in series so the sulfur dioxide gas may be passed first into the larger volume of solution, & what is there unabsorbed may pass on through the second flask.

$$Na_2CO_3 + 2SO_2 + H_2O \rightarrow 2NaHSO_3 + CO_2$$

After a short time a marked foaming occurs in the first flask due to the escape of carbon dioxide and after this foaming ceases a similar frothing soon commences in the second flask.

- The obtained solution of sodium bisulfite is place in a 600 ml beaker and cautiously treated with 53 g of sodium carbonate.

$$2NaHSO_3 + Na_2CO_3 \rightarrow 2Na_2SO_3 + CO_2 + H_2O$$

- The solution is boiled for 15 min then is treated with 48 g powdered sulfur wetted with small amount of ethanol and gently boiled under reflux for an hr & a half or longer.

$$Na_2SO_3 + S \rightarrow 2Na_2S_2O_3$$

- The obtained solution is filtered & the solution is left at room temperature in a crystallizing dish to set to crystallize.

Assay

- Titration with standard Iodine solution
- Starch as Indicator
- 0.8 g Sample + 30 ml water C.F
- Titrated with 0.1N standard Iodine solution
- 3ml starch indicator
- End point: yellow colour of Iodine gets discharges